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the ring, which now receives it, must necessarily fall upon the *southern* hemisphere of the ball, which has been remarkably dark ever since the southern surface of the ring has been illuminated; while the bright zone lies wholly in the *northern* hemisphere.—The remarkable obscurity of the southern hemisphere at the present time seems to indicate that the effect of the reflection from the surface of the ring is quite inappreciable as seen from the earth.

Wateringbury, Jan. 11, 1855,

Postscript.

"Jan. 14. The night proving fine, I again carefully examined *Saturn*, and made the following entry in my journal:—

"'12h 45m G.M.T. *Saturn* is very fine at times, though about 3¾h past the meridian. It bears 705 very well; and with this power I have no doubt of the southern edge of the ball extending over the division between A and B, and encroaching a trifle on the interior edge of A. With low powers (355 or less) there is sometimes an appearance of the division extending across; but I am persuaded that this arises from the combined effect of the division coming up on each side so near the apex, and the *very* deep tint of the apex itself, which I think is *darker* than the darkest part of the broad belt close to the equator of the planet. It is certainly much darker than the ring A.'"

On Rating Chronometers by Lunars. By H. Toynbee, Esq., Commander of the Gloriana, East Indiaman.

Previous communications from Captain Toynbee on this subject will be found in the *Monthly Notices*, vol. ix. No. 7, and vol. xiv. pp. 19 and 243. In the present paper he shows that lunar distances taken from the stars and planets may be still more advantageously employed for determining chronometer errors and rates than those taken from the sun.

His method is to take several sets of good lunars on each side of the moon, if it may be, on consecutive days, and from the *mean* of the whole to deduce a chronometer *error* corresponding to the *mean epoch*. This is to be done every month. The *rate* is determined by a comparison of the *error* of each month with the error of the preceding month, and the examples adduced by Captain Toynbee of his own practice, and of that of Captain Quihampton of the Tudor, are exceedingly satisfactory.

It is to be feared that, partly from the practical difficulty attending lunar observations, and partly from the extended use of chronometers in navigation, this excellent and independent method of finding the longitude is going out of use. Yet in long voyages it must always be dangerous to rely solely on chronometers, unless they are numerous, and have been rated *with reference*

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to the temperature, which is not the practice of private raters. Even then, there are so many causes which may operate to change the rates of chronometers at sea, that a conscientious officer ought never to risk his ship and the lives of his crew upon the going of his chronometers, without the additional check and security which he derives from lunars.

In his last voyages, Captain Toynbee has relied chiefly on lunar distances taken from the stars and planets, and they are generally taken on each side of the moon the same night. When distances are taken from both sides of the moon, most of the instrumental errors affect the results contrary ways, and almost to the same amount. Thus the index error and want of parallelism in the dark glasses disappear from the mean of east and west distances; and if the arc is nearly the same in both cases, even the defective plane of the index-glass, the want of perpendicularity in the index and horizon-glasses, and the error of the arc of the sextant, are nearly eliminated, or at any rate greatly attenuated. The sextant is so difficult an instrument to make and to adjust correctly, that only the very best artists can be trusted; and, after all, the observer should use it in such a way as to reduce as much as possible the effect of unavoidable and unknown errors: for this purpose he can scarcely follow a better example than Captain Toynbee.

The errors of the lunar tables are sometimes larger than would seem likely from Captain Toynbee's instances, yet his method of extending the observations (from which his mean distance is included) over so large an arc will tend to diminish even this effect, which cannot be completely guarded against. The *number* of observations gets pretty well rid of *casual* error, either of observation or of computation; and the instrumental errors are compensated by making them tell contrary ways.

The following instances will suffice to show the system pursued by Captain Toynbee and its results.

By a mean of 10 distances on each side of the moon on March 6, 7, 8, 9, 10, 11, chron. Dent, 1759, was found,—

1854, March 9,	$14^m\ 39^s{\cdot}6$ fast on G.M.T.

By 18 distances taken similarly between May 1 and May 10, the chron. was found,—

1854, May 6,	$22^m\ 38^s{\cdot}2$ fast on G.M.T.

By 14 similar distances taken between August 29 and Sept. 6, the chron. was found,—

1854, Sept. 2,	$40^m\ 35^s{\cdot}6$ fast on G.M.T.

By 8 similar distances taken between Sept. 27 and Oct. 6, the chron. was found,—

1854, Oct. 1,	$44^m\ 25^s{\cdot}9$ fast on G.M.T.

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By 12 similar distances between Oct. 31 and Nov. 3, the chron. was found,—

1854, Nov. 1, $48^{m}\ 9^{s}{\cdot}9$ fast on G.M.T.

By 8 similar distances between Nov. 30 and Dec. 1, the chron. was found,—

1854, Dec. 1, $52^{m}\ 19^{s}{\cdot}8$ fast on G.M.T.

The partial results are good, but not extraordinary. The excellence of the *means* arises from the number of observations and the compensation of the opposite errors.

The chronometer seems to have performed with great regularity, as the rates from the above data are,—$8^{s}{\cdot}4$; $9^{s}{\cdot}1$; $7^{s}{\cdot}9$; $7^{s}{\cdot}2$; $8^{s}{\cdot}1$: all gaining.

The computed error of the chronometer from the above *errors* and *rates*, deduced solely from lunar distances, was verified at Calcutta and the Cape by the time-ball, and on the return to England by the maker; the differences amounted only to a few seconds.

The observations from which these results are deduced were taken while the moon was between new and full, and generally between 6^{h} and 10^{m} P.M.,—a time which best suited Captain Toynbee's convenience. He proposes hereafter to try morning observations, by which an independent error and new rate will be determined every fortnight. Whether this will repay the trouble depends on the chronometers, which, if good, and more than one in number, should keep the Greenwich M.T. for a month pretty safely. Towards the end of a voyage, the error of the chronometer cannot be too carefully determined, and once a fortnight is not too often.

Captain Quihampton says that he should have been a degree out of his reckoning if he had relied on his shore-errors and rates; but by his lunar rates he made the Island of Flores and the Islands of Scilly within a very few miles.

On the Orbit of α Centauri. By Eyre B. Powell, Esq.

In this paper the author gives the details of an investigation of the orbit of *α Centauri.* Two sets of elements are deduced by him. The following is the second set, which he appears to have derived from equations of condition involving the corrections of the original elements:—

$\tau = 1858{\cdot}012$

$\pi = 29^{\circ}\ 33'$

$\Omega = 177\ 50$

$\gamma = 77\ 50$

$e = {\cdot}966$

$n = 4^{\circ}{\cdot}78$ $P = 75{\cdot}3$ years

$= 30'$